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Abstract

U. S. EXPERIENCE IN RADIOACTIVE WASTE MANAGEMENT AND RECENT TRENDS IN RESEARCH AND DEVELOPMENT

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Although the nuclear energy industry in the United States is relatively still in its infancy, significant strides have been made during the past six years in the radioactive waste management field to further reduce the volumes and quantities of radioactive material being discharged to our environment. The initial operation of central station nuclear power reactors during this period has resulted in waste quantities amounting to only a few per cent of original design estimates. However, the adoption of more stringent radiation protection guides in recent years has resulted in a vigorous and expanded research and development program in radioactive waste control, directed at further minimizing the release of radioactivity to our environment and at providing engineered practical systems for utilization in an expanding nuclear energy industry.

Operating experience and data from waste management systems at United States atomic energy facilities such as national laboratories, production sites, reactor testing facilities, and nuclear power reactor installations, are summarized. The efficiency of various treatment systems for large-volume low-activity waste from these operations is evaluated. Recent experience on tank storage of smaller-volume, high-activity waste is briefly discussed, and new management techniques for reducing future tank storage requirements are described.

Ground disposal experience and practice in the United States, which is utilized for certain types of solid and liquid waste effluents, are discussed. Industrial interest in providing waste disposal services for large volumes of solid, low-hazard potential waste continues to increase in the United States. Land burial and sea disposal operations during the past six years are discussed and the recent opening of commercial land burial facilities is noted.

The effectiveness of power reactor waste management systems is described and the extent and impact of these operations, in relation to other nuclear energy effluent control operations, are discussed.

The scope and direction of the U. S. waste management research and developments in synthetic ion-exchange, natural mineral exchange materials, foam separation, and hydrofracturing are discussed as potential future methods for improved control of low and intermediate waste. The possibilities of recycling and/or reusing processed waste streams in laboratory or reactor systems are also described.

The inherent restrictions of tank storage for high activity waste, such as potential leakage and necessity of liquid-waste transfer for periods of hundreds of years, has resulted in an extensive "conversion-to-solids" research and development effort in the U. S. Pilot plant results on various calcination and fixation techniques, such as fluidized beds, heated pots, and radiant heated spray colums, are discussed. The addition of glass-forming materials to high activity waste for the purpose of providing a more stable final product is also being investigated. The long-range waste management programs at plutonium production centers, such as Hanford and Savannah River, with their particular site requirements, are briefly described. The effects of fission product removal for beneficial use is discussed as it relates to long-term waste management operations.

The investigation of specific geologic formations, such as salt structures and impermeable crystalline rock for ultimate storage or disposal of calcined solids or certain types of liquid waste, is described. Plans for a proposed field experiment in salt with full-scale radioactivity are discussed.

Brief reference is made of the long-range engineering studies which are being conducted to evaluate the hazards and economics of various methods for handling, storage and/or ultimate disposal of high and low level liquid and solid wastes. Although treatment and disposal costs are substantial, they should not constitute a major obstacle in the development of a nuclear energy industry in the United States.